KING COUNTY INTERNATIONAL AIRPORT ECONOMIC IMPACT STUDY

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EXECUTIVE SUMMARY

King County International Airport (KCIA), popularly referred to as "Boeing Field, " is located in the industrial corridor of the cities of Seattle and Tukwila. It is the site of critical elements in the final production and delivery system for Boeing 737 and 757 product line aircraft, as well as the Boeing AWACS program. It is also the primary location for general aviation, corporate air activity, and a significant share of air cargo activity in the Central Puget Sound Region. As such, KCIA generates significant economic impacts upon the King County economy.

Directly, some 4,078 people were employed at KCIA in 1998, approximately 2,400 in the aerospace sector, and the balance in a host of air transportation industries, government agencies, and other industrial sectors. These businesses had revenues of about $976 million, and directly generated labor income of $187 million. Through linkage relationships with the local economy the total impact of the KCIA is much larger. These linkages are related to the purchases made by KCIA tenants, subtenants, and government agencies located there, as well as due to the spending of the labor income of those directly employed at KCIA. When these indirect and induced impacts are considered, the jobs created in the King County economy rise to 10,596, labor income is $362 million, and the value of sales by businesses located in the economy is $1.43 billion. Tax revenues generated by these transactions are estimated to be $15.4 million in state sales taxes, $5.3 million in local sales taxes, and $8.7 million in state B&O taxes.

Most industrial activity at KCIA is due to demands accruing outside the Central Puget Sound region, impacts due to "New Money." A more conservative measure of the economic impact of KCIA is derived by estimating the economic impacts of "New Money," e.g. business activity that would not occur in King County if the airport were not here. We estimate that the New Money impacts are about 75-80% of total impacts reported above. New Money employment impacts are estimated to be 7,687 jobs, labor income impacts are $279 million, and output or sales impacts are $1.18 billion. State sales tax impacts related to New Money are estimated to be $12.5 million, while local sales tax impacts are estimated to be $4.3 million, and state B&O tax impacts to be $7.3 million.

These results are based on a survey of tenants, subtenants, and government agencies located at KCIA. All tenants who were contacted provided cooperation to the consultants, with the quality of information varying from highly detailed accounting information to data of sufficient quality to undertake these economic impact estimates through the use of other secondary data. The 1987 Washington input-output model was the basis for the computation of King County impacts. It was regionalized through the use of the location quotient method of adjustment of direct requirements to obtain the total requirements matrix that formed the basis for estimation of indirect and induced economic impacts.

ACKNOWLEDGEMENTS

This study would not have been possible without the help of many people. We were entirely dependent upon the voluntary cooperation of businesses located at King County International Airport, as well as government agencies located there to complete this study. Every business that we contacted, and all government agencies, provided us with key information on their business operations that has been utilized in this economic impact study.

The time-line for undertaking this project has been short. We were contacted in July, and started the research project shortly after initial contact. KCIA staff was very helpful in paving the road to getting data from their tenants, but we must also say that tenants were always forthcoming with information on their businesses. We want to thank KCIA staff for providing information to tenants about the conduct of this study. In particular, we thank Clare Impett, Aviation Policy Planner, for her knowledgeable introduction to the functions undertaken at KCIA, and for her help identifying key contacts used in the conduct of this study. We also thank Cynthia Stewart, Airport Manager, for her help in contacting tenants and asking them to participate in this research project. We also want to thank Rommell Buenafe for his help with KCIA accounting information, and Pat Olds and Pat Terrell for their help in gaining information about tenants. We also want to thank the tenants who were rightfully worried about confidentiality with regard to their business activities for sharing with us information about their businesses. We would particularly like to thank the following individuals for their assistance: Frank Figg, Boeing Company; Peter G. Anderson, Galvin Flying Service; Mike Campion and Christopher Lee, UPS; Steve Lee, Wings Aloft; Dave Mallory, BAX Global; Peter Crane and Gene Peppetone, Airborne Express; Kathy McDonald and Michael Frederick COM Investments, LLC; Dave Badger, FEDEX; Rodney Fichter, Ameriflight; and Judy Galfano, Aviation Partners. And, we also wish to thank King County staff and KCIA tenants for their help in what we will call “soft” measures of impact: insights into geographic markets, changes in them, and shifts in the nature of the impacts we have documented here for the year 1998. All of these sources of information have been critical to the completion of this project.

Thank you to all of our informants!!

I. Introduction

King County International Airport, also known as Boeing Field (hereafter referred to as KCIA), is located in the industrial corridor of the cities of Seattle and Tukwila. Although the city boundaries cross the airport, KCIA is governed by the county pursuant to special provisions of state law related to airports. KCIA is an integral part of the larger Duwamish industrial area, which stretches from Elliott Bay south along the river valley to Tukwila. This airport serves a multitude of purposes and plays a vibrant role in the economy of the Central Puget Sound Region. In this report we document the economic impact of current business activities at the airport on the King County economy.

The report is organized as follows. First, in this section we discuss some issues related to the goals and objectives of this study. These include methodological considerations and data sources. In section II we describe the results of our efforts to measure the direct economic impacts of the airport. Then in section III we provide estimates of the indirect and induced impacts of the airport, through the use of a model that calculates multiplier effects associated with the direct economic impacts of the airport. In section IV we speak to other issues related to this study, including measurement issues, limits on our definition of impacts, and issues that would need to be addressed in similar future research. An appendix is included describing the input-output modeling approach. We also compare our results with an earlier study of the economic impact of KCIA that was conduced in 1997.

Study Goals

The goal of this study was documentation of the economic impacts of the KCIA on the King County economy in the year 1998. These impacts were to be measured using a version of the Washington State input-output model adapted for impact analysis in King County, which would provide measures of employment, sales, and labor income impact. In addition, estimates of tax revenue impact as measured by sales and B&O taxes were to be defined.

It is recognized at the outset that these measures of impact are narrow in their concept, for the KCIA is not only embedded in the larger Central Puget Sound Region economy as well as the Washington State economy, but business activities located at the airport are intimately tied to production occurring elsewhere in the region. Two examples will suffice to illustrate the latter issue.

The Boeing Company undertakes final work on two of its product lines at KCIA, the 737 and 757 jet aircraft. It also has its AWACS facility at the airport. The 737 and 757 production lines are intimately related to the production process for these aircraft in Renton, where tens of thousands of Boeing employees work.

There is insufficient space in Renton to complete the painting and other final delivery activity for these aircraft, so they are flown to KCIA to complete the production and delivery process. While this project documents the impact of the direct level of Boeing activity at KCIA, it does not include the impact of the much larger level of closely related activity located in Renton, nor impacts of the research and administrative functions located throughout the Puget Sound region that are related to these product lines.

The other example we develop is related to airfreight. Several large air freight operators have bases at KCIA, and several specialized air cargo carriers are also located there. KCIA serves as an interface between the aircraft carrying airfreight in and out of the airport, and as a point of trans-shipment into the ground based fleets of trucks that move this air cargo to and from local distribution centers where it is collected from clients or delivered to them. The clients within this region who are originating airfreight have business which is dependent on KCIA air cargo handlers. A similar relationship exists for inbound cargo with regard to shippers located in other regions. This study did not attempt to measure these off-site values or benefits related to the airfreight enterprises located at KCIA.

Study Methodology

The following narrative describes the general process we used to estimate impacts of KCIA. A more technical description of the input-output model is found in Appendix A.

Tenant and subtenant identification

KCIA staff kindly provided us with a list of current tenants, and also sent letters at our request to a set of key tenants indicating that we were undertaking this research project. The KCIA staff was also helpful in obtaining the names and locations of key individuals in the government agencies and private businesses located at KCIA. The consultants identified subtenants through interviews with primary tenants.

Interviews with tenants and subtenants

From August through October 1999 the consultants made appointments with tenants and government agencies for personal interviews, and also conducted telephone interviews with these organizations. They were told that the information that they provided us would be regarded as confidential, and would be aggregated with information obtained from other agencies and businesses to retain confidentiality.

Information of varying levels of detail was obtained from tenants and government agencies located at KCIA. In some cases respondents provided us

with their business records, and we compiled data into a format appropriate for use with the input-output model. In other cases key information such as the number of employees, the level of labor income, and business volume (sales) was provided. Some organizations conducted detailed special tabulations for us. We developed several baseline vectors of expenditures in industries that were of importance at the airport (such as air transportation, general government, and trucking). These were provided to some organizations that altered the composition of these baseline estimates to reflect their business activity. In the case of small businesses, some of whom were either sole proprietorships or had only 2 or 3 employees, the direct requirements coefficients were used from the King County input-output model to simulate their direct requirements. ALL MAJOR TENANTS AND PUBLIC AGENCIES PROVIDED BASELINE INFORMATION TO THE CONSULTANTS. *Appendix B lists the names of establishments included in this study.*

A note on the Museum of Flight. The Museum of Flight is located adjacent to KCIA, but it is not an airport tenant. However, the museum is dependent upon the use of airport property for the placement of some historic aircraft. Its displays and structures are also largely related to the history of the aerospace industry located in the Puget Sound region. Because of the strong identity in the community of this museum with KCIA, it was included in this study. Information for the Museum of Flight was drawn from files developed by Dr. Beyers as a part of the economic impact study of Arts and Cultural Organizations in King County completed earlier this year for the Corporate Council for the Arts (GMA Research and Beyers, 1999).

Although we have had a very high level of cooperation from businesses and government agencies located at KCIA there is certainly room for error in a project of this nature. However, we believe that our informants have provided us with a portrait of business activity at the airport that is quite complete.

Information obtained from individual tenants, subtenants, and government agencies was entered into a spreadsheet that was structured so as to aggregate their data into a format compatible with the input-output model. Results of this aggregation process are reported in section II of this report.

Updating the I/O model to 1998 price indices

The latest year for which there is a baseline input-output model in Washington State is 1987 (Chase, Bourque, and Conway). Two issues surround use of a 1987 model for an impact analysis for the year 1998. They are: the changes in prices among the model's sectors, and the issue of structural changes in the state economy. Let us deal with the second issue first. Research has been done in Washington State allowing the construction of five input-output models

spanning the years 1963 and 1987. Beyers has recently compared the interindustry structure of the 1963 and 1987 models, and found relatively little change in the interindustry transactions relationships at the state level (Beyers forthcoming). At the same time, the relative levels of output among industries have changed dramatically, but this change does not affect the impact analysis estimates because it is driven by the interindustry multiplier structure which has been found to be relatively stable.

There have been changes in relative prices for industrial output since the 1987 input-output model was constructed. In other work undertaken by Beyers and Conway indices were developed to deflate current final demand and direct requirements estimates to 1987 dollars (Conway and Beyers 1994; Conway and Beyers 1996). Beyers has continued to update these index numbers in applications of this model to the impacts of high technology industry (Beyers & Lindahl 1997; Beyers & Nelson 1998), and the impacts of arts and cultural organizations (GMA Research and Beyers 1999). These index numbers were further adjusted for the present impact study, utilizing a combination of U.S. Bureau of Economic Analysis and U.S. Department of Labor price indices.

Use of I/O model to estimate total impacts

The input-output model is driven by "final demands" and "direct requirements." Tables 1 and 2 in the next section of this report provide estimates of aggregate final demands and direct requirements. For the purposes of this study two estimates of impact are provided. The first is based on aggregate demand, and the second is related to "new money," that is demands that originate outside the King County economy. New money impacts are smaller than aggregate impacts, as they exclude what might be regarded as discretionary local spending. The exclusion of these outlays in this context is justified as follows. If KCIA were not present it could be argued that these expenditures would be redirected elsewhere in the local economy (or in the larger Central Puget Sound region economy). A more thorough description of modeling issues is presented in Appendix A. Measures of impact derived from the input-output model include (1) the value of industrial output (sales), (2) labor income and other value added, (3) employment, and (4) an estimate of selected tax revenues.

A brief overview of categories of economic activity located at KCIA

Aerospace

As indicated above, the Boeing Company has substantial operations at KCIA. The bulk of this activity is located on the west side of the field, but Boeing Business Jets—a new division--has established an office on the east side of the field. Boeing is not the only aerospace manufacturer located at KCIA, although it is by far the largest. Several other aerospace manufacturers make components, and representatives of engine manufacturers (and airlines) have staff located at

the field. The bulk of Boeing's employment is associated with the finishing and delivery work undertaken for the 737 and 757 product lines. However, the AWACS radar aircraft program is also located at the field.

F.B.O.'s, Corporate Air, and Flight Training Services

F.B.O.'s (fixed base operators), corporate air services, and flight training organizations exist in a number of locations on the east side of the airport. *F.B.O.'s* provide a variety of goods and services. Each establishment is unique in the mix of work undertaken. However, major elements of the activity of these organizations are fuel sales, flight training, aircraft service and sales, tie-down and hangar storage, and services for visiting and local general aviation and corporate aircraft. These services include arranging rental cars and / or transportation for corporate executives coming to the region to do business, as well as serving local corporate executives in their flight activity. These establishments relate to a variety of types of aircraft, ranging from helicopters to commercial aviation-sized jet aircraft. *Corporate* aircraft operations include establishments serving the needs of leading local business people; these facilities generally do not provide services for other aviation users. These operations include services such as hangar storage, fueling, maintenance, pilots and other in-flight staff. *Training.* Several organizations emphasize training while engaging in other services (including F.B.O's), while there are some establishments that are solely engaged in providing training services.

Air Cargo & Passenger Transportation

The air cargo business includes large package delivery organizations such as UPS, BAX Global, and Airborne. However, it also includes more specialized establishments such as Ameriflight and Aeroflight. The air cargo organizations typically have flights arriving before the start of the usual business day. These aircraft are quickly unloaded and reloaded and leave the airport early in the morning. They also typically have flights arriving late in the afternoon which are again quickly unloaded and reloaded, taking off in the early evening. Each carrier has a somewhat different organizational arrangement. However, there are generally separate divisions handling the ground activity and supporting the air activity. Much of the employment in this sector is part-time loading and unloading, in some cases on the staff of the air cargo carrier, and in other cases subcontracted. The same organizational differences exist with regard to the ground transportation segment of the industry. Specialized air courier services also are present, in some cases acting as feeders to larger air cargo carriers, and in other cases serving niche markets (such as check clearing courier services).

Retail & Wholesale

A modest number of retail organizations are found at KCIA, ranging from stores supplying aviation equipment or instruments, to a restaurant and a retail

nursery. In addition, several wholesalers are present, whose business is predominately aircraft-related.

Government

There are a host of government organizations located at KCIA. These include not only the airport administration, but also a number of other King County agencies that are making use of space at KCIA. The federal government also has a considerable presence, largely in the form of the FAA manned flight control tower, FAA staff involved with certification and delivery of Boeing aircraft, and the FAA Flight Service Station which provides weather information to aircraft around the region. There is a small Customs staff at the airport, serving arriving international corporate and general aviation needs, and the U.S. Immigration Service also utilizes KCIA. The State of Washington maintains a National Guard station at the north end of KCIA.

Producer Services and other businesses

Several producer services establishments are found at KCIA. These include accounting and engineering firms. Several other types of businesses are found at KCIA which have been included in this study, including The Museum of Flight and a construction company with offices at KCIA.

Manufacturing other than aerospace

There are also a few manufacturing firms making products for markets outside aerospace located at KCIA.

A note on Small General Aviation

KCIA is the location of several hundred small general aviation tie-downs, some of which pay rent directly to King County and others to FBO's. We had originally thought that we should survey a sample of these aviators. However, after discussion with several key members of the business community at KCIA we decided that this was not necessary in relation to King County economic impacts. The revenue paid by these aviators is included with King County government revenues and with the revenues of FBO's. Their expenditures for fuel, maintenance, and other operating costs incurred at KCIA is also included with other operators at KCIA, predominately FBO's. We became convinced that other local costs were negligible, and that a separate survey of these aviators was not required. KCIA tie-downs are the largest base for their activity; revenues to KCIA from these tenants are about 1% of KCIA revenue. This small percentage of KCIA revenue from these sources places in context the modest economic impact of this type of activity at KCIA in comparison to other business activity at KCIA. That said, we realize that the small general aviation function remains an important element in the matrix of aircraft activity that takes place at KCIA.

II. Direct Impacts

Direct impacts are defined as the outlays made directly in King County as a result of business activity at KCIA. These outlays are significantly below the total costs incurred by businesses located at KCIA, due to purchases made outside the local economy. For example, large quantities of fuel are sold to Boeing on behalf of its customers, and by FBO's located at KCIA. However, no jet fuel is manufactured in King County, and direct economic impacts are related to the margins associated with the distribution of this fuel locally to clients. (Those margins are included with the revenues reported by FBO's). Another measure of direct impact is associated with the labor force found at KCIA, as measured by the number of jobs and the level of labor income.

Table 1 documents the estimated magnitude of employment, sales, labor income, and labor income per employee for 1998. Over 4,000 persons worked at KCIA in 1998, earning some $186 million in labor income. Nearly $1 billion in sales occurred as a result of work performed there. The level of labor income per worker is quite varied, with relatively low compensation levels in non-aerospace manufacturing and retailing, and relatively high income levels in aerospace and producer services. The measurement of jobs includes full and part time jobs. Full time jobs constitute the majority of employment at KCIA except in the air cargo sector. While each air cargo carrier has a unique configuration of their labor force, all carriers that are engaged in cargo loading and unloading have sharply peaked part-time labor requirements (typically in the early morning and early evening) related to cargo handling operations. Part time employees in the air cargo business push down average earnings in this industry.

Table 1 Direct Employment, Sales and Labor Income

Industry Group	Jobs	Sales ($millions)	Labor Income ($ millions)	Labor Income per Job
Manufacturing Except Aerospace	19	$4.7	$.499	$26,263
Aerospace	2,390	$773.59	$126.27	$52,822
F.B.O.'s, Corporate Air, Flight Training	452	$67.34	$19.89	$44,004
Air Passenger and Air Cargo	630	$81.03	19.14	$30,381
Retail	36	$2.79	$.97	$26,944
Producer Services	74	$13.33	$4.97	$67,162
Government & Museum of Flight	477	$33.25	$14.86	$31,153
Total	4,078	$976.05	$186.59	$45,755

The various agencies and businesses located at KCIA purchase a wide variety of goods and services locally in their production process. The estimated

gross volume of these purchases is documented in Table 2, which reports these sales by the industries utilized in the input-output model. This table indicates some $118 million in purchases from industries in King County were made in relation to sales of some $976 million. The bulk of these purchases were of services, especially transportation, retail, finance, insurance, and real estate, business services, and "other" services. The bulk of the purchases of aerospace output were estimated to be internal transactions within the Boeing company, although many other respondents reported some local aerospace purchases.

Table 2 Estimated Direct Requirements ($ millions)

1 Agriculture	$0.0023
2 Forestry and Fishing	0.0033
3 Mining	0.0358
4 Food Products	1.4818
5 Apparel	0.0266
6 Wood Products	0.1189
7 Paper Products	0.4108
8 Printing	0.6320
9 Chemical Products	0.6650
10 Petroleum	1.1322
11 Stone, Clay, and Glass	0.0577
12 Primary Metals	0.1142
13 Fabricated Metals	1.4984
14 Nonelectrical Machinery	2.0098
15 Electrical Machinery	1.2819
16 Aerospace	13.6862
17 Ship and Boat Building	0.0001
18 Other Transportation Equipment	0.0761
19 Other Manufacturing	2.4753
20 Construction	5.7399
21 Transport Services	21.2518
22 Communications	3.4861
23 Utilities	5.0443
24 Wholesale and Retail Trade	9.0004
25 Finance, Insurance, and Real Estate	8.3740
26 Business Services	22.7425
27 Health Services	0.0089
28 Other Services	16.6658
Subtotal, King County Purchases	*118.0223*
29 Labor Income	186.5917
30 Other Value Added	26.7164
Imports from other regions	*644.7147*
Total Purchases	**976.0452**

Also included in Table 2 is an estimate of other value added (row 30), which includes profits, capital consumption allowances, and all other components of value added except labor income. Table 2 also includes the level of imports of goods and services from other regions (Washington state outside King County, from other states in the U.S. and from foreign countries) related to the value of production at KCIA.

The data in Tables 1 and 2 provide the baseline input data to the input-output model. Results from this baseline case are reported in section III below.

III. Direct, Indirect, and Induced Impacts

The input-output model calculates the impact of the direct expenditures reported in Tables 1 and 2 on the regional economy. Summary impacts resulting from this calculation process are presented in Table 3. This table indicates that output of $1.43 billion was generated in King County in 1998 due to business activity at KCIA, some 10,596 jobs were generated, and over $362 million in labor income was created.

Table 3 Direct, Indirect and Induced Impacts

Output (Mils. $98)	$1,431.863
Manufacturing	833.701
Nonmanufacturing	598.163
Construction	33.917
Wholesale and Retail Trade	99.282
Services	194.841
Other	270.123
Employment	10,596
Manufacturing	2,744
Nonmanufacturing	7,852
Construction	292
Wholesale and Retail Trade	1,735
Services	3,628
Other	2,197
Labor Income (Mils. $98)	$362.090
Manufacturing	141.479
Nonmanufacturing	220.611
Construction	10.435
Wholesale and Retail Trade	39.990
Services	94.689
Other	75.497

There are two sources of economic impact that lead to the increased levels of impact found in Table 3 when compared to Table 1. They are the linkages that industries have with each other that lead to multiplier effects, and Table 2 documented the direct source of those linkage-related impacts. Second, the spending by households of their labor income also leads to impacts, and these are predominantly within service industries. The direct level of labor income found in Table 1 or 2 is more than double the direct purchases of services documented in Table 2. This relatively large level of labor income contributes

significantly to the increased levels of output, employment, and labor income found in Table 3 when compared to Table 1.

Multipliers

Multipliers can be calculated from the data in Tables 1 and 3. Three such multipliers are presented in Table 4, and they can seen to be quite divergent in their value. The output multiplier is relatively low due to the dominance of the Boeing Company in the accounts driving these impact estimates. This is a byproduct of Boeing's weak interindustry purchases in the regional economy; the company relies on a global network of suppliers few of whom are located in the Puget Sound region. Other businesses included in this impact analysis also had a modest local purchasing propensity, only about 11% of total costs (excluding labor). The labor income and employment multipliers are pushed to higher levels by the relatively high wage level of those employed at KCIA. The average of $45,600 stands 10% above the county average for 1998, with aerospace earnings well above that figure. These relatively high wage levels stimulate the trade and services sectors in the input-output model, leading to the relatively higher labor income and employment multipliers.

Table 4 Multiplier Estimates

Output Multiplier	Employment Multiplier	Labor Income Multiplier
Defined as Total Sales in King County per Direct $ of Final Demand	Defined as Total Jobs in King County per Direct Job in King County	Defined as Total Labor Income in King County per Direct $ of Labor Income
$1.47	2.59	1.94

Tax revenue estimates

Estimates of sales and B&O taxes collected in relation to the impact estimates reported in Table 3 above were calculated through the use of 1998 reports of tax revenue compiled by the Washington State Department of Revenue, and estimates of the composition of personal income developed by the U.S. Bureau of Economic Analysis. Ratios were formed between levels of industrial output and B&O tax collections, and between levels of labor income and sales tax collections. These ratios yield an estimate of $15.422 million in State sales tax revenue, $5.318 in local sales tax collections in King County, and $8.736 million in state B&O tax collections. It should be noted that there are other fiscal impacts associated with KCIA, including a leasehold excise tax that is paid by tenants to KCIA, and which is in turn transferred to the cities of Seattle and Tukwila.

New Money Impacts

The impacts presented in Table 3 are related to all spending documented directly related to KCIA. However, as discussed in section I, some of this is local income that would likely be re-circulated if KCIA were not located in King County, while some "export" income to the county would disappear. The New Money measure of impacts is related to these exports. New Money impacts are less than gross impacts, being affected by the level and mix of industrial activity dependent upon local and export markets.

Table 5 presents estimates of the share of sales by broad industrial category that should be regarded as New Money. These estimates are based on the survey of tenants, subtenants, and government agencies. While the value of aerospace production and the very high level of exports in aerospace dominates the measures of New Money, Table 5 indicates significant shares of New Money in the air passenger and air cargo sector, as well as in retailing and the public sector plus the Museum of Flight.

Table 5 New Money Impact Measures

Industry Group	Total Sales ($millions)	% New Money
Manufacturing Except Aerospace	$4.7	19.1%
Aerospace	$773.59	99.8%
F.B.O.'s, Corporate Air, Flight Training	$67.34	27.6%
Air Passenger and Air Cargo	$81.03	52.4%
Retail	$2.79	45.8%
Producer Services	$13.33	19.0%
Government & Museum of Flight	$33.25	35.1%
Total	$976.04	87.0%

Estimates of the economic impact of New Money are obtained through the same procedure as was used to calculate the aggregate impacts reported in Table 3. The percentages of New Money that each tenant, subtenant, or government organization reported was multiplied against the total revenue, employment, and direct purchases. The resulting estimates of New Money related activity were then summed across sectors, and entered into the input-output model. The results of this impact estimate are presented in Table 6.

New Money impacts are not strictly proportional to the overall percentage of sales as indicated in Table 5 because of differing regional multiplier effects among sectors, differing labor requirements levels among sectors, and differing labor income requirements. The overall estimate of output in Table 6 is approximately 83% of the impacts recorded in Table 3, while the level of jobs is

approximately 74% and the level of labor income is approximately 77% of the magnitudes reported in Table 3. However, there are important differences in the composition of the impacts related to New Money, which is revealed by a comparison of estimates in Tables 3 and 6. The impacts within the manufacturing sector are very similar in both tables—simply a reflection of the strong external market orientation of the aerospace sector. In contrast, the various services found at KCIA have stronger local markets, leading to diminished service industry impacts when viewed from the New Money perspective.

Table 6 New Money Impacts

Output (Mils. $98)	$1,184.687
Manufacturing	816.609
Nonmanufacturing	368.078
Construction	23.442
Wholesale and Retail Trade	73.221
Services	127.257
Other	144.159
Employment	7,867
Manufacturing	2,653
Nonmanufacturing	5,214
Construction	200
Wholesale and Retail Trade	1,283
Services	2,537
Other	1,194
Labor Income (Mils. $98)	$278.558
Manufacturing	138.025
Nonmanufacturing	140.533
Construction	7.168
Wholesale and Retail Trade	29.565
Services	63.853
Other	39.947
Tax Impacts (Mils $98)	
State Sales Tax	$12.547
Local Sales Tax	4.327
Total Sales Taxes	16.874
B&O Tax Impact	7.280

Both the overall and New Money impact estimates indicate that employment and labor income impacts are strongest in the various services

sectors. This result is a byproduct of the regional structure of the input-output model that has strong linkages between labor income and the expenditure of this labor income on services by household consumers. In contrast, many goods purchased by households in retail stores are not manufactured in Washington state, and therefore the impacts of these purchases are felt in other regions. This same principle of leakage also applies to the direct and indirect impacts related to production at KCIA. An example of one major input to the air transportation and aerospace sectors there is fuel. No fuel is manufactured in King County; some of what is consumed at KCIA is manufactured in northern Puget Sound, and some is imported from other states. The local impacts associated with fuel consumption are service industry margins related to the delivery of this fuel. These margins have been captured in the direct purchases contained in Table 2, and the impacts of production of fuel are exogenous to this model.

IV. Concluding Comments

This report provides estimates of the economic impact of KCIA on the King County economy for the year 1998. Let us first discuss some limitations of the present analysis, then turn to a comparison of our results with several previous studies, and end with some concluding comments.

Limitations of the data

The impact estimates contained in this report are based on good quality information provided by tenants, subtenants, and government agencies located at KCIA. However, the quality of the information provided varied in detail, and we have utilized secondary information when complete data was not provided in a format compatible with the input-output model. We could well have made errors in the application of these secondary data to information provided to us. For example, many organizations provided us with estimates of the size of their labor force, their wage bill, and their aggregate revenues. We then utilized data from the input-output model (and other analyses that utilized this model) to estimate direct requirements for each establishment included in this study. It is possible that these relationships may not be exactly equivalent to what would have been obtained through a complete audit or accounting inventory.

We have tried to identify all tenants, subtenants, and government agencies with a presence at KCIA. However, there is a chance that we have missed some activity, but its magnitude is likely small.

We have also used a regionalized version of the Washington State input-output model. The regionalization method (described in Appendix A) could also produce error, but we believe that it yields multipliers that are reasonable.

It is often the case that analysts undertaking economic impact studies report the results with many digits of accounting detail, which looks very "accurate." However, it is important to recognize that results in any such study are subject to error, and should be regarded as estimates of "true "economic impacts.

Comparison to the other two previous studies

Two previous studies of KCIA were made available to the consulting team for our review (Gambrell 1996, Gambrell 1997). These studies were undertaken using rather different methodology than utilized in this study. We will provide a limited comparison of our results with the 1997 study at this point in our report.

The 1997 study utilized an aggregated version of the 1987 Washington input-output model to calculate economic impacts. This model had nine sectors,

corresponding to the division level statistical categories of the U.S. Bureau of the Census. The authors claim that the impact estimates are direct, indirect, and induced requirements impacts. However, careful checking of the multiplier structure used in this report reveals that only the direct and indirect impacts are modeled. The induced effects of consumption are not included in the multiplier table (Table 9) in the 1997 study. Even if survey methods had been the same, this one difference in model specification is a major source of differences in results between these two studies.

A direct comparison of results is presented in Table 7. The modest ratio of indirect and induced jobs, output, and labor income impacts found in the 1997 when compared to the current study is likely to be due to the failure to include induced effects in the 1997 study. There are other major differences in methodology that make the two studies noncomparable, even if both studies relied upon the 1987 Washington State input-output model. Moreover, there have been changes in the level and composition of economic activity since the 1987 input-output study has been completed. These changes have not significantly altered multipliers, but they have altered the relative importance of output among industries in the Washington economy.

Table 7 Some Comparisons of Impacts found in this study and in the 1997 Impact Study of KCIA

Measure	**Current Study**	**1997 Study**
Direct Jobs	4,078	4,466
Indirect & Induced Jobs	6,518	2,174
Direct Labor Income	$187 million	$111 million
Indirect & Induced LY	$175 million	$48 million
Direct purchase of local goods & services	$118 million	$154 million
Final Demand	$976 million	? – not reported
Total Output	$1,431 million	$774.3

Concluding Comments

This report documents the significance of KCIA to the King County economy. The level of business activity found at KCIA is relatively evenly split between the east and west sides of the field when measured by jobs. However, the relatively high value of Boeing's products tips the balance of value of output distinctly towards the west side of the field. Yet, the east side of the field is a beehive of corporate and small general aviation activity, air cargo, engineering, manufacturing, and retailing. The myriad of government agencies present

around the airport also contributes to the feeling of "hustle and bustle" along the perimeter road.

There appear to be opportunities for further economic development at KCIA. Some businesses that we interviewed were optimistic about growth in business activity. Without naming individual businesses, this type of optimism was expressed by a new F.B.O., by existing air cargo tenants, by a manufacturer of aerospace components, and by a specialized wholesaler. Growth in air cargo demands, expanded corporate air activities, growth in high-technology manufacturing, and the expansion of producer services related to the air industry are certainly possibilities in the future at KCIA.

A major factor surrounding future economic impacts of KCIA is the future of the Boeing Company. Two Boeing-related factors with impacts on KCIA are: (1) the company's success in obtaining new orders, and (2) how the company interfaces its production activities elsewhere in the region with its facilities at KCIA. In the short-run, it appears as though the Boeing Company will have a reduced level of output. However, the aerospace industry is highly cyclical, and in the future the high output level currently being supported by work at KCIA could be sustained.

This report has described the current impact of activities at KCIA. However, these impacts will surely change as the tenants, subtenants, and government agencies located at KCIA alter their business concepts. They will also shift as existing establishments move elsewhere or cease business, and as new establishments enter the milieu. Thus, in a few years it may well be useful to undertake another study of this type to document current impacts of KCIA on the regional economy.

Appendix A Input-Output Modeling Approach[1]

The impact estimates developed in this study stem from the utilization of an "input-output model." Models of this type are based on static, cross-sectional measures of trade relationships in regional or national economies. They document how industries procure their inputs and where they sell their outputs. Pioneered by Wassily Leontief, who won the Nobel Prize in Economic Science for his insights into the development of input-output models at the national level, these models have become "workhorses" in regional economic impact analysis in recent decades.

Washington state is fortunate to have a rich legacy of research developing input-output models. Led by Professor Emeritus Philip J. Bourque of the University of Washington Graduate School of Business, along with the late Charles M. Tiebout, input-output models have been estimated in Washington state for the years 1963, 1967, 1972, 1982, and 1987. No other state in the United States has this rich historical legacy of survey-based regional input-output models.

Input-output models decompose regional economies into "sectors"--groups of industries with a common industrial structure. The heart of these models are "Leontief production functions," which are distributions of the cost of producing the output of sectors. Leontief augmented the national accounts schema developed by Kuznets (also a Nobel laureate in economics) to take into account the significant levels of intermediate transactions that occur in economic systems in the process of transforming raw materials and services into "finished products," or "final products." Sales distributions among intermediate and final sources of demand are used as the accounting bases for the development the core innovation of Leontief: that these relationships can be used to link levels of final demand to total industrial output by way of a system of "multipliers" that are linked through the channels of purchase in every industry to the production of output for final demand.

This system of relationships is based on accounting identities for sales. Mathematically, this system of relationships may be represented as follows. For each industry we have two balance equations:

(1) $X_i = x_{i,1} + x_{i,2} + ... + x_{i,n} + Y_i$

[1] This appendix is largely the same as appears in Beyers and Lindahl 1997. That report was prepared with regard to impacts on the state of Washington; the present analysis is focussed on King County, and the text has been adjusted to describe how we have changed the Washington State model for the purposes of this study.

(2) $X_j = x_{1,j} + x_{2,j} + ... + x_{n,j} + V_j + M_j$

where: X_i =total sales in industry i,
X_j = total purchases in industry j
$x_{i,j}$ = intermediate sales from industry i to industry j
Y_i = final sales in industry i
M_j = imports to sector j
V_j = value added in sector j.

For any given sector, there is equality in total sales and total purchases:

(3) $X_i = X_j$ when i=j.

This system of transactions is generalized through the articulation of Leontief production functions, which are constructed around the columns of the regional input-output model. They are defined in the following manner.

Let us define a regional purchase coefficient:

$$r_{i,j} = x_{i,j} / X_j.$$

Rearranging,

$$x_{i,j} = r_{i,j} X_j$$

Substituting this relationship into equation (1) we have:

(4) $X_i = r_{i,1}X_1 + r_{i,2}X_2 + ... + r_{i,n}X_n + Y_i$

Each sector in the regional model has this equation structure, and since the values of X_i equal X_j when i=j, it is possible to set this system of equations into matrix notation as:

(5) $X = RX + Y$

This system of equations can then be manipulated to derive a relationship between final demand (Y) and total output (X). The resulting formulation is:

(6) $X = (I-R)^{-1}Y$

where the $(I-R)^{-1}$ matrix captures the direct and indirect impacts of linkages in the input-output model system. The input-output model utilized in the modeling for this research project was developed by aggregating the 1987 Washington

State input-output model from its original specification at the level of 62 sectors to 28 sectors[2]. In this application state level direct requirements coefficients have been modified to reflect the industrial structure of King County. This has been done through the "location quotients" method of coefficient adjustment, whereby rows in the state direct requirements coefficients have been multiplied by location quotients. Location quotients define the relative importance of industries in a region compared to a benchmark region, in this case King County compared to Washington State. In cases where location quotients are less than 1, it is presumed that the region cannot supply output to industries at a level equal to that of the benchmark region, and as such direct requirements coefficients are modified by multiplying the row coefficients in the benchmark region by the location quotient values (less than 1) to produce estimated direct requirements coefficients for the region. We used employment data for Washington State and King County to make this adjustment for the model used in this impact study.

A major issue that surrounds the estimation of the $(I-R)^{-1}$ matrix is the level of "closure" with regard to regional final demand components, which are personal consumption expenditures, state and local government outlays, and capital investment. It is common practice to include the impacts of labor income and the disposition of this income in the form of personal consumption expenditures in the multiplier structure of regional input-output models. The additional leveraging impact of these outlays is referred to as "induced" effects in the literature on models of this type. It is less common to include state and local government expenditures in the induced effects impacts, but it can be argued that demands on state and local governments are proportional to the general level of business activity and related demographics. In contrast, investment is classically argued to be responsive to more exogenous forces, and is not a simple function of local business volume[3].

In the model that we developed for this impact study we have included personal consumption expenditures and state and local government expenditures as a part of the induced-demand linkages system. We have considered Washington personal consumption expenditures to be a function of labor income. We have considered state and local government expenditures to be a function of other components of value added. The resultant Leontief inverse matrix is displayed in Table A.1.

The 1987 Washington State input-output model, which forms the benchmark for the analyses conducted in this study, was estimated at the level of 62 sectors[4]. For the purposes of this impact study the model was aggregated to 28 industrial

[2] See Chase, R., Bourque, P., and Conway, R.
[3] For a discussion of these modeling issues see Conway or Hewings in our references.
[4] See Chase, R., Bourque, P., and Conway, R.

sectors and had personal consumption plus state and local government expenditures included in the model to capture the induced impacts related to these two "final demand" categories. Estimates of demand, employment, income, and direct expenditures for the year 1997 were used to calculate the impact estimates. The specific form of the model used in this analysis takes into account price and labor productivity changes between 1987 and 1997 for each sector.[5] Other models that have been used for various impact studies in Washington State include the Washington Policy and Simulation Model (WPSM) developed by Conway, and IMPLAN models developed by the U.S. Forest Service. The WPSM model is an integrated econometric and input-output model; it has a more inclusive structure than the Washington input-output model used here, leading to higher and time-distributed multipliers.[6] The IMPLAN models have a structure which is similar to the Washington input-output model; they are based on the benchmark U.S. model, and have been used for analyses of issues such as the impact of old growth forest conservation strategies.[7] For the purposes of this impact analysis, the Washington input-output model provides an excellent basis for calculating impacts. Utilization of these other models would yield similar, but not identical, levels of impact as presented later in this report.

[5] See Conway, R. & Beyers, W.
[6] See Conway, R.
[7] See Carroll et al..

Table A.1
Direct, Indirect, and Induced Requirements Table

(Columns show final demand sector)	1	2	3	4	5	6	7	8	9	10
1 Agriculture	1.00572	0.00034	0.00023	0.00711	0.00040	0.00025	0.00023	0.00028	0.00028	0.00006
2 Forestry and Fishing	0.00147	1.01469	0.00099	0.01118	0.00072	0.11493	0.00940	0.00111	0.00104	0.00022
3 Mining	0.00108	0.00062	1.01047	0.00110	0.00050	0.00059	0.00110	0.00058	0.00133	0.00041
4 Food Products	0.05748	0.02601	0.01908	1.06189	0.01737	0.02092	0.01978	0.02335	0.02301	0.00465
5 Apparel	0.00151	0.00097	0.00096	0.00093	1.00764	0.00164	0.00092	0.00115	0.00205	0.00022
6 Wood Products	0.00354	0.00381	0.00373	0.00242	0.00152	1.11745	0.08608	0.00343	0.00295	0.00069
7 Paper Products	0.00321	0.00198	0.00187	0.01142	0.00379	0.00249	1.03558	0.02501	0.00503	0.00089
8 Printing	0.01280	0.01230	0.01136	0.01183	0.00974	0.01173	0.01047	1.02257	0.01437	0.00281
9 Chemical Products	0.02454	0.00716	0.00913	0.00395	0.00144	0.00643	0.03684	0.00577	1.04383	0.00095
10 Petroleum	0.00372	0.00268	0.00212	0.00138	0.00118	0.00230	0.00326	0.00164	0.00200	1.00220
11 Stone, Clay, and Glass	0.00446	0.00528	0.01566	0.02051	0.00362	0.00479	0.00437	0.00397	0.00601	0.00308
12 Primary Metals	0.00028	0.00076	0.00035	0.00045	0.00024	0.00059	0.00030	0.00030	0.00038	0.00017
13 Fabricated Metals	0.00505	0.00661	0.00884	0.02232	0.00268	0.01180	0.00566	0.00578	0.00751	0.00178
14 Nonelectrical Machinery	0.00160	0.00142	0.00407	0.00166	0.00080	0.00402	0.00217	0.00115	0.00161	0.00050
15 Electrical Machinery	0.00058	0.00263	0.00193	0.00059	0.00050	0.00271	0.00072	0.00066	0.00114	0.00044
16 Aerospace	0.00022	0.00024	0.00016	0.00020	0.00012	0.00035	0.00028	0.00015	0.00304	0.00005
17 Ship and Boat Building	0.00079	0.01203	0.00064	0.00057	0.00059	0.00204	0.00070	0.00077	0.00073	0.00015
18 Other Transportation Equipment	0.00074	0.00028	0.00027	0.00035	0.00023	0.00078	0.00028	0.00030	0.00030	0.00007
19 Other Manufacturing	0.00629	0.01012	0.00473	0.00899	0.00391	0.01066	0.00885	0.01765	0.00925	0.00258
20 Construction	0.06783	0.09744	0.07558	0.04953	0.06746	0.06782	0.06584	0.06953	0.09350	0.02297
21 Transport Services	0.03267	0.02613	0.02537	0.02967	0.02560	0.06992	0.03991	0.02902	0.02786	0.01022
22 Communications	0.02864	0.02251	0.02642	0.01779	0.03106	0.02455	0.02122	0.03549	0.02684	0.00559
23 Utilities	0.05905	0.03203	0.04694	0.04083	0.03680	0.04551	0.10197	0.04252	0.07125	0.02914
24 Wholesale and Retail Trade	0.21788	0.16123	0.15796	0.15176	0.15751	0.18863	0.17697	0.20987	0.20816	0.04553
25 Finance, Insurance, and Real Estate	0.07861	0.06812	0.08320	0.04956	0.06651	0.07807	0.06531	0.08085	0.07552	0.01514
26 Business Services	0.03177	0.03731	0.04114	0.04351	0.04685	0.03346	0.03516	0.07064	0.04116	0.00838
27 Health Services	0.07326	0.05938	0.06087	0.03965	0.05469	0.06066	0.05287	0.07287	0.06891	0.01341
28 Other Services	0.08861	0.07553	0.10045	0.05405	0.07185	0.08316	0.06970	0.10105	0.09477	0.01690
29 Labor Income	0.75006	0.58274	0.61635	0.39936	0.56139	0.61901	0.53311	0.74162	0.69395	0.13124
30 Other Value Added	0.49002	0.90312	0.54449	0.39755	0.33653	0.44723	0.51794	0.57592	0.69337	0.21139

Table A.1
Direct, Indirect, and Induced Requirements Table, continued

(columns show final demand sector)	11	12	13	14	15	16	17	18	19	20
1 Agriculture	0.00027	0.00018	0.00021	0.00026	0.00027	0.00016	0.00026	0.00022	0.00027	0.00035
2 Forestry and Fishing	0.00103	0.00066	0.00078	0.00090	0.00098	0.00054	0.00156	0.00083	0.00153	0.00250
3 Mining	0.02362	0.00238	0.00051	0.00054	0.00063	0.00034	0.00065	0.00048	0.00054	0.00375
4 Food Products	0.02272	0.01527	0.01774	0.02184	0.02254	0.01353	0.02107	0.01857	0.02108	0.02223
5 Apparel	0.00104	0.00112	0.00086	0.00105	0.00109	0.00068	0.00233	0.00089	0.00176	0.00105
6 Wood Products	0.00321	0.00154	0.00188	0.00182	0.00229	0.00092	0.00847	0.00214	0.00847	0.01730
7 Paper Products	0.00773	0.00200	0.00391	0.00291	0.00387	0.00162	0.00188	0.00290	0.00398	0.00278
8 Printing	0.01250	0.00884	0.01002	0.01303	0.01247	0.00731	0.01204	0.01221	0.01255	0.01282
9 Chemical Products	0.00448	0.00631	0.00811	0.00468	0.00343	0.00146	0.00442	0.00499	0.01262	0.00362
10 Petroleum	0.00566	0.00185	0.00138	0.00152	0.00151	0.00092	0.00160	0.00128	0.00141	0.00250
11 Stone, Clay, and Glass	1.04087	0.00299	0.00372	0.00376	0.00385	0.00193	0.00504	0.00336	0.00429	0.04825
12 Primary Metals	0.00067	1.02808	0.01319	0.00281	0.00098	0.00023	0.00130	0.00074	0.00120	0.00323
13 Fabricated Metals	0.00646	0.00398	1.02048	0.01340	0.03185	0.00341	0.00912	0.00898	0.00742	0.02602
14 Nonelectrical Machinery	0.00285	0.00242	0.00671	1.02483	0.00555	0.00300	0.00454	0.00174	0.00393	0.00234
15 Electrical Machinery	0.00078	0.00127	0.00056	0.00704	1.01356	0.00133	0.00236	0.00127	0.00447	0.00402
16 Aerospace	0.00024	0.00017	0.00314	0.00020	0.00453	1.01486	0.00712	0.00727	0.00019	0.00023
17 Ship and Boat Building	0.00075	0.00052	0.00057	0.00070	0.00073	0.00046	1.00366	0.00058	0.00067	0.00072
18 Other Transportation Equipment	0.00031	0.00021	0.00090	0.00154	0.00030	0.00017	0.00107	1.00536	0.00027	0.00057
19 Other Manufacturing	0.00808	0.00751	0.01250	0.01134	0.02561	0.00593	0.01183	0.01616	1.03991	0.00994
20 Construction	0.10353	0.05381	0.06221	0.06664	0.06821	0.03233	0.09178	0.06003	0.06323	1.06107
21 Transport Services	0.05185	0.03487	0.02267	0.02588	0.02526	0.01448	0.02150	0.01874	0.02831	0.02981
22 Communications	0.02977	0.01791	0.02436	0.02902	0.02981	0.01675	0.02424	0.02281	0.02747	0.02728
23 Utilities	0.11371	0.17198	0.03736	0.03932	0.05630	0.02439	0.04863	0.03538	0.03977	0.04081
24 Wholesale and Retail Trade	0.19699	0.15097	0.17625	0.21139	0.21934	0.11344	0.19614	0.18239	0.19026	0.23327
25 Finance, Insurance, and Real Estate	0.08436	0.05197	0.06503	0.07377	0.08078	0.04494	0.06689	0.05970	0.07164	0.08131
26 Business Services	0.06064	0.02679	0.03836	0.04244	0.04842	0.03320	0.03466	0.03313	0.03848	0.03398
27 Health Services	0.06539	0.04563	0.05369	0.06669	0.06922	0.04442	0.06718	0.05602	0.06223	0.06559
28 Other Services	0.09051	0.05935	0.08056	0.08777	0.09408	0.06599	0.07786	0.07103	0.08217	0.13097
29 Labor Income	0.66452	0.46185	0.54912	0.68015	0.71100	0.46118	0.70065	0.56799	0.63273	0.67311
30 Other Value Added	0.53778	0.41112	0.36936	0.49821	0.41596	0.16873	0.19148	0.48584	0.50493	0.40644

Table A.1
Direct, Indirect, and Induced Requirements Table, continued

(Columns indicate final demand sector)	21	22	23	24	25	26	27	28	29	30
1 Agriculture	0.00033	0.00029	0.00021	0.00054	0.00030	0.00040	0.00043	0.00045	0.00053	0.00016
2 Forestry and Fishing	0.00105	0.00094	0.00070	0.00229	0.00107	0.00119	0.00137	0.00139	0.00165	0.00053
3 Mining	0.00071	0.00063	0.00705	0.00081	0.00094	0.00068	0.00081	0.00086	0.00084	0.00048
4 Food Products	0.02848	0.02352	0.01666	0.05558	0.02430	0.03045	0.03570	0.03551	0.04386	0.01268
5 Apparel	0.00149	0.00117	0.00083	0.00144	0.00121	0.00150	0.00221	0.00188	0.00223	0.00062
6 Wood Products	0.00188	0.00182	0.00164	0.00231	0.00286	0.00208	0.00200	0.00246	0.00213	0.00150
7 Paper Products	0.00278	0.00286	0.00219	0.00652	0.00362	0.00479	0.00310	0.00397	0.00347	0.00137
8 Printing	0.01574	0.01516	0.01232	0.03081	0.04368	0.02519	0.02146	0.02929	0.02169	0.00865
9 Chemical Products	0.00234	0.00208	0.00226	0.00297	0.00292	0.00356	0.00900	0.00345	0.00305	0.00135
10 Petroleum	0.00907	0.00164	0.00123	0.00204	0.00180	0.00245	0.00262	0.00303	0.00264	0.00098
11 Stone, Clay, and Glass	0.00452	0.00480	0.00438	0.00575	0.00751	0.00465	0.00601	0.00593	0.00572	0.00423
12 Primary Metals	0.00049	0.00031	0.00034	0.00035	0.00050	0.00031	0.00034	0.00038	0.00036	0.00027
13 Fabricated Metals	0.00491	0.00370	0.00353	0.00484	0.00519	0.00388	0.00468	0.00528	0.00486	0.00298
14 Nonelectrical Machinery	0.00378	0.00113	0.00214	0.00164	0.00175	0.00252	0.00155	0.00428	0.00152	0.00081
15 Electrical Machinery	0.00108	0.00176	0.00096	0.00085	0.00097	0.00170	0.00107	0.00154	0.00084	0.00052
16 Aerospace	0.00415	0.00011	0.00009	0.00017	0.00013	0.00015	0.00018	0.00018	0.00017	0.00007
17 Ship and Boat Building	0.00339	0.00076	0.00054	0.00093	0.00080	0.00100	0.00104	0.00114	0.00148	0.00038
18 Other Transportation Equipment	0.00151	0.00031	0.00023	0.00040	0.00034	0.00038	0.00039	0.00096	0.00051	0.00018
19 Other Manufacturing	0.00729	0.00707	0.00592	0.00824	0.00802	0.01205	0.02215	0.01323	0.00851	0.00383
20 Construction	0.07434	0.08709	0.08129	0.09302	0.14730	0.08034	0.08726	0.09944	0.09579	0.08018
21 Transport Services	1.07338	0.02156	0.01745	0.03461	0.02608	0.03051	0.03348	0.03439	0.03430	0.01301
22 Communications	0.03456	1.02845	0.02367	0.04241	0.06420	0.05034	0.04404	0.04991	0.04510	0.01443
23 Utilities	0.04387	0.03932	1.24332	0.06537	0.06250	0.05123	0.06683	0.06919	0.06431	0.02078
24 Wholesale and Retail Trade	0.22449	0.19177	0.13561	1.24123	0.20177	0.25701	0.26655	0.30825	0.35520	0.09004
25 Finance, Insurance, and Real Estate	0.10247	0.08520	0.06779	0.11893	1.23417	0.11748	0.16428	0.15879	0.13433	0.04106
26 Business Services	0.05084	0.03929	0.03313	0.07220	0.07748	1.08067	0.06063	0.08919	0.04841	0.02568
27 Health Services	0.08035	0.07473	0.05219	0.08260	0.07716	0.09682	1.16808	0.11029	0.14662	0.03775
28 Other Services	0.11655	0.10392	0.06868	0.12349	0.12508	0.13296	0.14646	1.17457	0.15112	0.04503
29 Labor Income	0.82671	0.74797	0.51568	0.84066	0.77755	0.99549	1.03533	1.13575	1.52518	0.34108
30 Other Value Added	0.45592	0.84288	0.72350	0.65309	0.76662	0.56160	0.50265	0.60556	0.49655	1.16526

Appendix B. List of Establishments providing business information included in this study

FBO's and Corporate Air	Bicknell subtenants (aircraft sheet metal repair; fastner wholesaler; helicopter maintenance; aircraft modifications)
Galvin Flying Service	Aerocopters
Galvin subtenants (corporate air, service contractors, hearing / health services)	Aerocopters subtenants
COM Investments, LLC	Aeroflight
Nordstrom Inc.	Aeroflight subtenants (construction; instrument repair; jet charters; helicopters)
Bicknell	TAG Aviation
Retail/Wholesale/Service	
Intercoastal Hardware (Bicknell subtenant)	Rosso Nursery
Joseph Finelli	Aviation Fuel Storage Co
National Aviation Supply	Mutual Enterprises
Cavu Cafe	Airtech Instruments
Contract Controllers CPA	Museum of Flight[8]
Government	
King County International Airport	Washington State Aeronautics
King County Dept. of Safety & Claims	King County Dept. of Public Safety
Federal Aviation Administration	King County Sheriff Department
King County Division of Emergency Management	King County DCFM Storage
Washington National Guard	FAA Flight Service Station
U.S. Customs Service	
Manufacturing	
The Boeing Company	Western Metals
X-Ray Inc	True-Coat
Air Carriers	
Helijet	West Isle Air
Air Freight	
Ameriflight	Ameriflight subtenants (trucking)
BAX Global (air and ground operations)	BAX Global subtenants (trucking)
Federal Express	United Parcel Service
Airborne Express (ground and air operations)	
Air related	
Wings Aloft	Aviation Training Center
Classic Helicopters	Classic Helicopters subtenants (mfg. representative; air service related)
Aviation Partners	Engine Manufacturer's representatives, within Boeing Company complex
FAA and Boeing Customers, Boeing Flight Test Center	Wings Aloft subtenants (aircraft repair, aviation parts, consulting, avionics repair, helicopter training, manufacturers representative)

[8] Data obtained from Corporate Council for the Arts economic impact study database developed by Dr. Beyers

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